

WHAT IS CLAIMED IS:

1. A multi-layer printed circuit board having buildup layers formed on both sides of a core substrate, the buildup layers each having interlayer resin insulating layers and conductive
5 layers alternately provided, the conductor layers connected to one another by via holes, wherein

through holes are formed to penetrate said core substrate and the interlayer resin insulating layers formed on the both sides of the core substrate; and

10 the via holes are formed right on said through holes, the via holes connected to external connection terminals.

2. A multi-layer printed circuit board according to claim 1, wherein

resin filler is filled in said through holes and the
15 conductor layers are formed to cover exposed surfaces of the resin filler from the through holes; and

the via holes right on said through holes are formed on said conductor layers of said through holes.

3. A method of manufacturing a multi-layer printed circuit
20 board comprising at least the following steps (a) to (d):

(a) forming lower interlayer resin insulating layers on both sides of a core substrate, respectively;

(b) forming through holes penetrating said core substrate and said lower interlayer resin insulating layers;

25 (c) forming upper interlayer resin insulating layers on said lower interlayer resin insulating layers, respectively; and

(d) forming via holes in said upper interlayer resin insulating layers, the via holes connected to external connection terminals and formed right on part of said through holes.

4. A method of manufacturing a multi-layer printed circuit board comprising at least the following steps (a) to (g):

(a) forming lower interlayer resin insulating layers on both sides of a core substrate, respectively;

(b) forming through holes penetrating said core substrate and said lower interlayer resin insulating layers;

(c) filling resin filler in said through holes;

(d) polishing and flattening the resin filler pouring from said through holes;

(e) forming conductor layers covering exposed surfaces of said resin filler from said through holes;

(f) forming upper interlayer resin insulating layers on said lower interlayer resin insulating layers, respectively; and

(g) forming via holes in said upper interlayer resin insulating layers and forming the via holes right on part of said through holes so as to be connected to external connection terminals.

5. A multi-layer printed circuit board having interlayer resin insulating layers on both sides of a core substrate, respectively, through holes provided to penetrate the core substrate and filled with resin filler, the interlayer resin insulating layers and conductor circuits provided, wherein said resin filler contains an epoxy resin, a curing agent

and 10 to 50% of inorganic particles.

6. A multi-layer printed circuit board having interlayer resin insulating layers formed on both sides of a core substrate, respectively, through holes provided to penetrate the core substrate and filled with resin filler, plated covers provided, the interlayer resin insulating layers and conductor circuits provided, wherein

said resin filler contains an epoxy resin, a curing agent and 10 to 50% of inorganic particles.

7. A multi-layer printed circuit board according to claim 5 or 6, wherein

said inorganic particles contain one type or more selected from a group consisting of aluminum compounds, calcium compounds, potassium compounds, magnesium compounds and silicon compounds.

8. A multi-layer printed circuit board according to claim 6 or 7, wherein

a shape of said inorganic particles is one of a spherical shape, a circular shape, an ellipsoidal shape, a pulverized shape and a polygonal shape.

9. A multi-layer printed circuit board according to any one of claim 6 to 8, wherein

rough layers are provided on the conductor layers of said through holes, respectively.

10. A method of manufacturing a multi-layer printed circuit board having interlayer resin insulating layers provided on both sides of a core substrate, for forming the interlayer resin insulating layers through the following steps (a) to (e):

(a) a formation step of forming through holes penetrating the both sides of the printed circuit board;

(b) a filling step of filling resin filler containing an epoxy resin and 10 to 50% of inorganic particles;

5 (c) a drying step and a polishing step;

(d) a hardening step; and

(e) a cover plating step.

11. A method according to claim 10, wherein

10 in said polishing step (c), a buffing step is conducted at least once or a plurality of times.

12. A method according to claim 10 or 11, wherein

in said step (a), a step of forming rough layers is conducted.

13. A multi-layer printed circuit board having buildup layers on both sides of a core substrate, respectively, said buildup layer having interlayer resin insulating layers and conductor layers alternately provided, the conductor layers connected to one another by via holes, wherein

20 through holes filled with resin filler are formed to penetrate said core substrate and lower interlayer resin insulating layers formed on the both sides of the core substrate; and

via holes filled with said resin filler are formed in said lower interlayer resin insulating layers.

25 14. A multi-layer printed circuit board according to claim 13, wherein

the conductor layers are formed to cover exposed surfaces

of the resin filler filled in the via holes of said lower interlayer resin insulating layers; and

via holes are formed right on the via holes through the conductive layers, respectively.

5 15. A method of manufacturing a multi-layer printed circuit board comprising at least the following steps (a) to (g):

(a) forming lower interlayer resin insulating layers on both sides of a core substrate, respectively;

10 (b) forming penetrating holes in said core substrate and said lower interlayer resin insulating layers, the penetrating holes becoming through holes;

(c) forming openings in said lower interlayer resin insulating layers, the openings becoming via holes;

15 (d) forming conductive films in said penetrating holes and said openings to thereby provide the through holes and the via holes, respectively;

(e) filling resin filler in said through holes and said via holes;

20 (f) polishing and flattening the resin filler pouring out of said through holes and said via holes; and

(g) forming conductor layers covering exposed surfaces of said resin filler from said through holes and said via holes, respectively.

25 16. A method of manufacturing a multi-layer printed circuit board comprising at least the following steps (a) to (i):

(a) forming lower interlayer resin insulating layers on both sides of a core substrate, respectively;

(b) forming penetrating holes in said core substrate and said lower interlayer resin insulating layers, the penetrating holes becoming through holes;

(c) forming openings in said lower interlayer resin insulating layers, the openings becoming via holes;

(d) forming conductive films in said penetrating holes and said openings to provide the through holes and the via holes;

(e) filling resin filler in said through holes and said via holes;

(f) polishing and flattening the resin filler pouring out of said through holes and said via holes;

(g) forming conductor layers covering exposed surfaces of said resin filler from said through holes and said via holes;

(h) forming upper interlayer resin insulating layers on said lower interlayer resin insulating layers, respectively; and

(i) forming via holes in said upper interlayer resin insulating layers and right on part of said via holes.

17. A method of manufacturing a multi-layer printed circuit board comprising at least the following steps (a) to (e):

(a) forming lower interlayer resin insulating layers on both sides of a core substrate, respectively;

(b) forming penetrating holes in said core substrate and said lower interlayer resin insulating layers, the penetrating holes becoming through holes;

(c) forming openings in said lower interlayer resin insulating layers, the openings becoming via holes;

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(d) conducting a de-smear process to said penetrating holes by an acid or an oxidizer and conducting a roughing process to surfaces of the lower interlayer resin insulating layers; and

5 (e) forming conductive films on said penetrating holes and said openings to provide the through holes and the via holes, respectively.

18. A method according to claim 17, wherein

10 said core substrate is made of one of a glass epoxy resin, an FR4 resin, an FR5 resin and a BT resin;

each of said lower interlayer resin insulating layers contains at least one of an epoxy resin, a phenol resin, a polyimide resin, a polyphenylene resin, a polyolefin resin and a fluorocarbon resin; and

15 said oxidizer contains one of a chromic acid and permanganate.

19. A method according to claim 17, wherein

20 said acid contains one type or more selected from a group consisting of a sulfuric acid, a hydrochloric acid, a nitric acid, a phosphoric acid and a formic acid.

20. A method according to claim 17, wherein

said oxidizer contains one of a chromic acid and permanganate.

21. A method of manufacturing a multi-layer printed circuit

25 board comprising at least the following steps (a) to (d):

(a) forming through holes in a core substrate;

(b) forming rough layers on said through holes,

respectively;

(c) polishing and flattening surfaces of lands of said through holes; and

(d) filling resin filler in said through holes and
5 forming resin layers.

22. A method according to claim 21, wherein
said rough layers are copper oxide layers.

23. A method according to claim 21, wherein
said rough layers are formed by etching.

10 24. A method according to claim 21, wherein
said rough layers are needle alloy layers made of
copper-nickel-phosphorous.

25. A method according to any one of claims 21 to 24, wherein
said resin filler is one selected from a group consisting
15 of a mixture of an epoxy resin and organic filler, a mixture
of an epoxy resin and inorganic filler and a mixture of an epoxy
resin and inorganic fiber.

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